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ORIGINAL ARTICLE

Identifying patients at risk for urinary retention following inguinal herniorrhaphy: a single institution study

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Abstract

Purpose We aim to identify patients at risk for post-operative urinary retention (POUR) and factors associated with POUR.

Methods Males who underwent inguinal hernia repair (IHR) from June 2010 to September 2014 at a single institution were grouped according to the presence (symptomatic) or absence (asymptomatic) of preoperative urogenital symptoms (UGS). Patients ≤ 18 years of age were excluded. POUR was defined as the need to catheterize a patient who had not voided 6 h after surgery. Data were examined using IBM SPSS v23.0.

Results Of the 60 asymptomatic and 30 symptomatic patients identified, no differences were seen in age (55 vs. 65, $p = 0.13$), length of stay > 1 day (3% vs. 13%, $p = 0.09$), bilateral inguinal herniation (23% vs. 23%, $p = 1.00$), or laparoscopic approach (70% vs. 69%, $p = 1.00$); however, significant differences were seen in POUR (5% vs. 27%, $p = 0.01$) and α-blocker utilization (50% vs. 80%, $p = 0.01$). When age-matched, neither POUR (10% vs. 27%, $p = 0.10$) or α-blocker utilization (57% vs. 80%, $p = 0.05$) significantly differed between asymptomatic and symptomatic patients, respectively. Logistic regression analysis demonstrated that only bilateral inguinal herniation (OR 6.55, $p = 0.03$) and symptoms (OR 6.78, $p = 0.02$) were associated with POUR. Asymptomatic patients with a unilateral hernia have a 4.3% risk of POUR, whereas symptomatic patients with a bilateral inguinal hernia have at 57.1% risk.

Conclusions We demonstrate that bilateral inguinal herniation and UGS independently increase the risk of POUR, whereas α-blockers do not. For the general surgical population, α-blockers should not be routinely prescribed to all patients and instead should be limited to high-risk patients.

Keywords Urinary retention · Inguinal hernia · Surgery · Alpha-blocker

Introduction

Inguinal hernia repair (IHR) remains one of the most common surgical procedures performed in the United States [1]. In 2010 alone, an estimated 449,000 IHRs were performed, making it the most commonly performed surgery of the abdomen or gastrointestinal system, accounting for 1% of 48.3 Million ambulatory procedures performed that year [1]. While IHRs are often elective outpatient procedures, some patients require admission for a variety of reasons. One of the most common indications for admission following IHR is post-operative urinary retention (POUR). This is defined as "the inability to spontaneously urinate following surgery, requiring straight catheterization or placement of a Foley catheter" [2]. With an overall incidence up to 22% following IHR, POUR contributes to a significant number of admission that are otherwise potentially avoidable and leads to not only patient discomfort, but also increased morbidity and cost [3].

The aim of this study is to identify patient groups that are at high- and low-risk for POUR following IHR at a single institution. Factors previously reported to increase the risk of POUR after IHR include older age, a preoperative diagnosis of benign prostatic hypertrophy (BPH), and narcotic usage, whereas judicious intravenous fluid infusion and

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use of α-blockers are reported to decrease this risk [3–10]. Among those studies, results vary, and little consensus exists as to what factors truly determine a patient's risk of POUR. Clinical trials were conducted in prior years; however, the results are less relevant to contemporary practitioners given the advances in surgical and anesthetic techniques [4, 6, 8, 10, 11]. We hypothesize that specific variables exist that are independently associated with an individual's risk of POUR following IHR.

Methods

Following institutional review board approval, a retrospective analysis of prospectively collected data at a single institution was conducted for patients undergoing IHR from June 2010 to September 2014. Males over 18 years of age who underwent laparoscopic or open IHR were included for analyses. All surgeries were performed by one of four fellowship-trained minimally invasive surgeons. Foley catheterization was routinely used preoperatively. Post-operative urinary retention was defined as the need to catheterize a patient 6 h after surgery for those who had not yet voided. All study procedures for this single-center retrospective study were reviewed and approved by the UNMC Institutional Review Board. A waiver for patient written informed consent was obtained for this study.

Outcomes measured

Patient characteristics including age, body mass index (BMI), and past medical history were collected as was preoperative utilization of α-blockers. Hernia characteristics including laterality and type were collected. Patients classified as having received an α-blocker either were prophylactically prescribed daily Tamsulosin (0.4 mg) for 2 weeks prior to surgery or were already taking either Prazosin or Doxazosin on a routine basis. Patients prescribed Tamsulosin prior to surgery who did not experience POUR continued treatment for 1 week after surgery, whereas those with POUR remained on Tamsulosin for 1 month or were referred to urology. Surgical data included length of stay (LOS), operative room (OR) time, surgical approach, and blood loss.

Statistical analyses

Patients were grouped based on the preoperative presence (symptomatic) or absence (asymptomatic) of urogenital symptoms (UGS) including urinary straining, increased urinary frequency, history of BPH, or routine preoperative α-blocker use. Patients were deemed as asymptomatic if none of these factors were present. Initial analyses were made between the symptomatic and asymptomatic groups with additional comparisons made for age-matched groups. Outcomes were also analyzed based on preoperative use of an α-blocker. Logistic regression analysis of patient age, presence of preoperative UGS, hernia laterality, blood loss, OR time, and α-blocker utilization were performed to determine which variables were independently associated with POUR. Categorical data were expressed as frequencies, whereas continuous data were presented as mean ± standard deviation (SD). Pearson's Chi-squared test, Fischer's exact, one-way ANOVA, and Mann–Whitney *U* tests were applied as indicated. Statistical analyses were conducted using IBM SPSS v.23.0, with a level of significance of 0.05.

Results

A total of 90 males met criteria for inclusion in this study (mean age 58 ± 12.0 years). Of these, 30 were classified as having preoperative UGS (symptomatic) and the remaining 60 were asymptomatic. Laparoscopic repair was completed in 62 patients ($N=42$ for asymptomatic patients and $N=20$ for symptomatic patients) (Table 1). Of patients who received an α-blocker, 24 had pre-existing UGS and routinely took Prazosin or Doxazosin whereas 30 did not have pre-existing UGS and were prophylactically treated with Tamsulosin. For all patients, no significant differences were found between asymptomatic and symptomatic patients with regards to age (55 ± 12.0 vs. 65 ± 10.2, $p=0.126$), LOS > 1 day (3.3% vs. 13.3%, $p=0.093$), bilateral inguinal herniation (23.3% vs. 23.3%, $p=1.000$) or laparoscopic approach (70.0% vs. 69.0%, $p=1.000$); however, significant differences were seen in rates of POUR (5.0% vs. 26.7%, $p=0.005$) and α-blocker utilization (50.0% vs. 80.0%, $p=0.006$) (Table 1). When asymptomatic and symptomatic patients were matched for age (n = 30 for both groups), no significant differences were seen for either POUR (10.0% vs. 26.7%, $p=0.095$) or α-blocker utilization (56.7% vs. 80.0%, $p=0.052$); however, asymptomatic patients were more likely to have intraoperative blood loss greater than 10 mL (60.0% vs. 30.0%, $p=0.020$) and were more likely to have a recurrent inguinal hernia (23.3% vs. 0%, $p=0.011$) (Table 2).

Analysis of patients who either did or did not receive an α-blocker preoperatively demonstrated that patient age (64 ± 11.6 vs. 51 ± 16.8, $p<0.001$), symptoms (44.4% vs. 16.7%, $p=0.007$), bilateral inguinal herniation (31.5% vs. 11.1%, $p=0.040$), and laparoscopic approach (81.1% vs. 52.8%, $p=0.005$) significantly differed between the groups, respectively (Table 3). Logistic regression analysis of all patients demonstrated that bilateral inguinal herniation and preoperative UGS were the only factors independently associated with POUR with odds ratios of 6.553 (95% CI 1.158–37.079, $p=0.033$) and 6.777 (95% CI 1.294–35.494, $p=0.024$), respectively. Patient age (OR 1.039, 95% CI

Table 1 Outcomes between groups, all patients

Factor[a]	Asymptomatic ($n=60$)	Symptomatic ($n=30$)	p -value*
Age (years)	55 ± 12.0	65 ± 10.2	0.126
POUR	3 (5.0%)	8 (26.7%)	**0.005**
α-blockers utilization	30 (50.0%)	24 (80.0%)	**0.006**
OR time (min)	82 [66.0–107.5]	79.5 [68.0–103.0]	0.831
LOS > 1 day	2 (3.3%)	4 (13.3%)	0.093
Bilateral inguinal hernia	14 (23.3%)	7 (23.3%)	1.000
Laparoscopic approach	42 (70.0%)	20 (69.0%)	1.000
Blood loss > 10 mL	31 (51.7%)	9 (30.0%)	0.072
Recurrent hernia	7 (11.7%)	0	0.090
BMI ≥ 35	16 (26.7%)	5 (20.8%)	0.781

*p-value significant if lower than 0.05 (in bold)

[a]Data displayed as N (%), mean ± SD, or median [IQR]

Table 2 Outcomes between age-matched groups

Factor[a]	Asymptomatic ($n=30$)	Symptomatic ($n=30$)	p -value*
Age (years)	60.5 ± 12.9	65.6 ± 12.3	0.126
POUR	3 (10.0%)	8 (26.7%)	0.095
α-blockers utilization	17 (56.7%)	24 (80.0%)	0.052
OR time (min)	80 [66.0–105.3]	79.5 [67.8–105.5]	0.796
LOS > 1 day	0	4 (13.3%)	0.112
Bilateral inguinal hernia	4 (13.3%)	7 (23.3%)	0.317
Laparoscopic approach	18 (60.0%)	20 (69.0%)	0.472
Blood loss > 10 mL	18 (60.0%)	9 (30.0%)	**0.020**
Recurrent hernia	7 (23.3%)	0	**0.011**
BMI ≥ 35	9 (30.0%)	5 (20.8%)	0.445

*p-value significant if lower than 0.05 (in bold)

[a]Data displayed as N (%), mean ± SD, or median [IQR]

Table 3 Outcomes between alpha-blocker utilization

Factor[a]	Alpha-blocked preoperatively		p -value*
	Yes ($n=54$)	No ($n=36$)	
Age (years)	64 ± 11.6	51 ± 16.8	< **0.001**
POUR	9 (16.7%)	2 (5.6%)	0.104
Symptomatic	24 (44.4%)	6 (16.7%)	**0.007**
OR time (min)	82 [69.5–102.3]	80.5 [66.0–115.8]	0.830
LOS > 1 day	4 (7.4%)	2 (5.6%)	1.000
Bilateral inguinal hernia	17 (31.5%)	4 (11.1%)	**0.040**
Laparoscopic approach	43 (81.1%)	19 (52.8%)	**0.005**
Blood loss > 10 mL	20 (37%)	20 (55.6%)	0.083
Recurrent hernia	4 (7.4%)	3 (8.3%)	1.000
BMI ≥ 35	10 (20%)	11 (32.4%)	0.199

*p-value significant if lower than 0.05 (in bold)

[a]Data displayed as N (%), mean ± SD, or median [IQR]

0.976–1.105, $p=0.299$), operative time (OR 0.976, 95% CI 0.946–1.006, $p=0.117$), blood loss > 10 mL (OR 0.964, 95% CI 0.181–5.129, $p=0.965$), and preoperative α-blocker use (OR 1.093, 95% CI 0.172–6.954, $p=0.925$) were not independently associated with POUR (Table 4). Asymptomatic patients with a unilateral inguinal hernia were determined to have a risk of 4.3% of POUR, whereas patients with bilateral inguinal hernias and preoperative UGS have a risk of 57.1% (relative risk of 13.3).

Discussion

Post-operative urinary retention continues to be a significant morbidity following IHR. The increased patient discomfort, risk of urinary tract infection, cost, and extended hospital stay are all reasons to minimize rates of POUR.

Table 4 Logistic regression analyses of factors associated with POUR

Factor	OR	95% CI		*p* -value*
		Lower	Upper	
Patient age	1.039	0.976	1.105	0.299
OR time	0.976	0.946	1.006	0.117
Hernia laterality				
Unilateral	Reference			0.033
Bilateral	6.553	1.158	37.079	
Blood loss				
≤ 10 mL	Reference			0.965
> 10 mL	0.964	0.181	5.129	
Alpha-blocker use				
No	Reference			0.925
Yes	1.093	0.172	6.954	
Symptomatic				
No	Reference			0.024
Yes	6.777	1.294	35.494	

To accomplish this, it will be necessary to identify which patients are at high-risk and effectively intervene.

Our data demonstrates that patients with bilateral inguinal hernias and a history of urogenital symptoms are at increased risk of POUR. In our cohort, we report that POUR occurred in 12% ($n=11$) of our patients, which is consistent with previously published rates [2–7, 10]. Our study included a larger age range, only excluding adolescents. We believe this may explain why the majority of our patients did not have urogenital symptoms prior to surgery; however, we also believe this is more representative of the overall patient population undergoing IHR. Considering that 23% ($n=21$) of our patients had a BMI ≥ 35, 8% ($n=7$) had a recurrent inguinal hernia, 23% ($n=21$) had bilateral inguinal hernias, and 69% ($n=62$) underwent laparoscopic repair with OR times approaching 80 min for both laparoscopic and open approaches, we believe that the results of our study are more generalizable than prior studies which had more restrictive inclusion criteria [4, 6, 10, 11]. Additionally, 60% ($n=54$) of our patients were α-blocked prior to surgery and we believe this allows us to draw conclusions regarding its potential benefit.

We performed several analyses to ascertain the risks or benefits of several factors associated with POUR in patients undergoing IHR. In prior studies, univariate and multivariable analyses were most frequently performed; however, logistic regression analyses were infrequently performed. We chose to perform logistic regression analyses because it simultaneously accounts for all variables and allowed us to determine which factors are truly independently associated with the outcomes of interest (POUR). In doing so, we failed to demonstrate that α-blockade significantly reduced the risk of POUR. This is in contrast to previous studies with varying methodologies; however, we did find that bilateral inguinal hernias and UGS were significantly associated with POUR, which is consistent with prior reports [5, 7, 9]. This makes logical sense as longer operative times and more anesthetic are required for bilateral inguinal hernia repairs and patients with poor micturition as baseline may be less likely to successfully initiate urinary flow following IHR.

Few clinical trials have been completed and significant variation exists among their methods and results [4, 6, 10, 11]. In 1988, Goldman and colleagues conducted an open-label prospective study randomizing 102 patients to receive either no treatment or Phenoxybenzamine. All patients were over 60 years of age, 83% received regional anesthesia, and patients with POUR underwent suprapubic catheterization, as opposed to urethral catheterization. While POUR rates were reduced with Phenoxybenzamine (0% vs. 26%, $p<0.01$), four patients experienced significant orthostatic hypotension [10]. In 1995, Woo and colleagues were unable to demonstrate that Prazosin reduced the risk of POUR in a randomized placebo-controlled trial. While this study was blinded to the investigator and patients, the nursing staff was aware of the trial and only 2 of 70 patients experienced POUR [4]. In 1999, Gonullu and colleagues demonstrated that Prazosin reduced the risk of POUR in a randomized placebo-controlled study of 156 males; however, of the 27 patients classified as having developed POUR, less than half required catheterized [11]. In 2010, Mohammadi-Fallah and colleagues randomly assigned 80 males to receive either Tamsulosin or placebo prior to open IHR without mesh. Only patients over age 50 without urologic complaints who had a unilateral non-recurrent hernia were included. A small but significant reduction in catheterization frequency was noted in the Tamsulosin arm (2.5% vs. 15%, $p=0.04$) [6]. Two randomized double-blinded clinical trials are currently underway (NCT03314259 and NCT02958878) which aim to determine if prophylactic α-blockade reduces the risk POUR in patients undergoing IHR in today's practice environment; however, both have yet to accrue.

This study has limitations in addition to its retrospective nature. One patient had a remote history of prostate cancer, one had a history of both prostate and bladder cancer, and another had a prior history of bladder rupture, which could have impacted their outcomes. Nonetheless, all were in the symptomatic group, and only the first routinely took an α-blocker. Regardless, none developed POUR, and logistic regression was applied to account for this potential bias. A significant limitation to this study is that intraoperative fluid administration was not accounted for. Patients who received unknowingly higher amounts of intravenous fluids may have been at higher risk for POUR. Patients with symptomatic urinary retention also received post-void residuals; however, this data is not routinely documented in the medical record and we were, therefore, irretrievable given the retrospective

nature of this study, further limiting our findings. For future prospective studies, it would be beneficial to collect these data. This size of this study also limits the generalizability of the results; however, we do believe that the patients included in this analysis are a better representation of the overall population of patient who are undergoing inguinal hernia repair. Another limitation is that 93% of the patients included in this study had a LOS of 1 day. If the LOS was collected in hours instead, a significant difference may have been found.

Modifiable factors such as intravenous volume infused, operative time, α-blockers, type of anesthesia, narcotics, operative approach, and mesh have all been proposed as potential areas of intervention to reduce the risk of POUR; however, little consensus exists, and surgical practices vary. Additionally, what defines POUR varies in the literature, and a standard definition would be helpful both for clinical and research purposes. Until sufficient data is available to determine not only the intervention, but also the patient population in which to perform it, clinical judgement will continue to dictate the perioperative management of patients undergoing IHR to reduce the risk of POUR.

Our data demonstrates that, when considering the entire spectrum of patients undergoing IHR, α-blockade does not reduce the risk of POUR. We do believe that α-blockers may have protective effects, but only in high-risk patients. Further work is required to better define this population and demonstrate the efficacy of α-blockers in this population in a modern surgical practice. To best address the efficacy of α-blockers in patients undergoing inguinal hernia repair, a prospective study would need to be completed and prospectively collect information relevant to factors that this study was less able to examine given its retrospective nature including pain scores, measurement of post-void residuals volumes, and fluid administration. We recommend that α-blockers only be used in patients perceived to be at high-risk for POUR, which would include patients with preoperative UGS or bilateral inguinal hernias.

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Compliance with ethical standards

Conflict of interest Authors BH, PRA, BG, and DL declare no conflict of interest. DO is a shareholder in Virtual Incision Corporation, and received Research Grant not related to the submitted work from Medtronic and Gore.

Ethical approval All study procedures for this single-center retrospective study were reviewed and approved by the UNMC Institutional Review Board.

Human and animal rights This study including human participants has been performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments.

Informed consent A waiver for patient written informed consent was obtained for this study.

References

1. Hall MJ, Schwartzman A, Zhang J, Liu X (2017) Ambulatory surgery data from hospitals and ambulatory surgery centers: United States, 2010. Natl Health Stat Rep 102:1–5
2. Patel JA, Kaufman AS, Howard RS, Rodriguez CJ, Jessie EM (2015) Risk factors for urinary retention after laparoscopic inguinal hernia repairs. Surg Endosc 29(11):3140–3145. https://doi.org/10.1007/s00464-014-4039-z
3. Koch CA, Grinberg GG, Farley DR (2006) Incidence and risk factors for urinary retention after endoscopic hernia repair. Am J Surg 191(3):381–385. https://doi.org/10.1016/j.amjsurg.2005.10.042
4. Woo HH, Carmalt HL (1995) A placebo controlled double blind study using perioperative prazosin in the prevention of urinary retention following inguinal hernia repair. Int Urol Nephrol 27(5):557–562. https://doi.org/10.1097/00005392-199803000-00179
5. Sivasankaran MV, Pham T, Divino CM (2014) Incidence and risk factors for urinary retention following laparoscopic inguinal hernia repair. Am J Surg 207(2):288–292. https://doi.org/10.1016/j.amjsurg.2013.06.005
6. Mohammadi-Fallah M, Hamedanchi S, Tayyebi-Azar A (2012) Preventive effect of tamsulosin on postoperative urinary retention. Korean J Urol 53(6):419–423. https://doi.org/10.4111/kju.2012.53.6.419
7. Mason SE, Scott AJ, Mayer E, Purkayastha S (2016) Patient-related risk factors for urinary retention following ambulatory general surgery: a systematic review and meta-analysis. Am J Surg 211(6):1126–1134. https://doi.org/10.1016/j.amjsurg.2015.04.021
8. Shaw M, Pahari H (2014) The role of peri-operative use of α-blocker in preventing lower urinary tract symptoms in high risk patients of urinary retention undergoing inguinal hernia repair in males above 50 years. J Indian Med Assoc 112:13–14
9. Blair AB, Dwarakanath A, Mehta A et al (2017) Postoperative urinary retention after inguinal hernia repair: a single institution experience. Hernia 21(6):895–900. https://doi.org/10.1007/s10029-017-1661-4
10. Goldman G, Leviav A, Mazor A et al (1988) α-adrenergic blocker for posthernioplasty urinary retention: prevention and treatment. Arch Surg 123(1):35–36. https://doi.org/10.1001/archsurg.1988.01400250037005
11. Gonullu NN, Dulger M, Utkan NZ, Canturk NZ, Alponat A (1999) Prevention of postherniorrhaphy urinary retention with prazosin. Am Surg 65(1):55